CloudWave - Leveraging DevOps for Cloud Management and Application Development

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The CloudWave Project Consortium**

1 Introduction

DevOps describes the convergence of application development and operation activities. In a DevOps team, software developers and system administrators collaborate in joint task forces and work towards common goals. The vision of the CloudWave project[1] is that a *full-stack DevOps* approach to cloud management can lead to more efficient usage of clouds as well as to better applications. This is achieved by aligning the goals of cloud application developers and cloud operators, and by allowing developers to leverage deeper knowledge of the cloud hosting environment. For cloud operators, the CloudWave model enables *more efficient instance management*, as application developers collaborate with the cloud provider, for example by exposing adaptation enactment points or emitting relevant business metrics. In return, cloud application developers gain deep insight into the internals of the cloud system, and can hence build and tune their application based on *real-time feedback from the cloud*. Similar to DevOps, the collaborative model of CloudWave removes friction between cloud operators and software developers by breaking up the black boxes that clouds and applications traditionally are to each other. CloudWave will provide a reference implementation of these ideas based on Openstack[2].

2 Project Consortium

CloudWave (full title *Agile Service Engineering for the Future Internet*) is an FP7 ICT Call 10 funded European research project. The project is coordinated by Eliot Salant (IBM Research Israel). In addition, the CloudWave consortium consists of SAP SE, Intel Ireland, Telecom Italia, Atos, Cloudmore, University of Duisburg-Essen, University of Messina, Technion, and University of Zurich.

3 Project Overview

A high-level outline of CloudWave is sketched in Figure 1. At the heart of the project, monitoring data is generated, analyzed, and aggregated on all levels of the cloud stack,

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[1] http://cloudwave-fp7.eu/

[2] http://www.openstack.org

i.e., on physical, virtual, network, and application level. This data is further enriched with information coming from external sources. We refer to this monitoring approach as *3-D monitoring* [1]. 3-D monitoring fuels two primary use cases, coordinated adaptation and feedback-driven development.

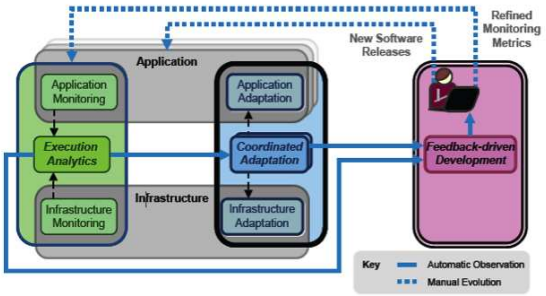

Fig. 1: High-Level Overview of the CloudWave Project

Coordinated adaptation is to improve the quality of adaptation decisions, taken by the infrastructure and application, through reasoning on the global state of the cloud stack provided by 3-D monitoring. By taking decisions in a coordinated manner, more effective adaptations are taken and operated by different components [2]. To this aim, adaptation models of the application (e.g., turning optional application features on or off based on load) and infrastructure (e.g., scaling up or out) are captured by Feature-based models and adaptation plans are derived by an intelligent engine.

Conversely, *feedback-driven development* (FDD) aims to bring 3-D monitoring data to software developers, giving them a better understanding of how the application is actually operated (and adapted) at runtime. This goes way beyond traditional application performance monitoring (APM) solutions, as the CloudWave monitoring solution integrates data from the application stack with infrastructure metrics, information on triggered adaptations, and data from other applications launched by the same tenant. CloudWave demonstrates how this data can provide added value to software developers, for instance via visualizing (and warning about) performance-critical code directly in the Integrated Development Environment (IDE), or by enabling what-if analysis of performance and costs for different deployment options [3].

References

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